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1976

REVISED MARSH FUNNEL CALIBRATIONS FOR MEASURING FIRE RETARDANT VISCOSITY

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ABSTRACT

Updates data (Research Note INT-91) for measuring viscosity of fire retardants in the field by means of the Marsh Funnel. New data cover Tenogum and gum-thickened Fire-Trol 931. Data for Gelgard (no longer available) have been dropped.

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In 1966, the Marsh Funnel was first modified so that the viscosity of forest fire retardants could be quickly and inexpensively determined in the field (George and Hardy 1966, 1967).

Because of changes in the retardants and formulations, procedures for measuring viscosity were revised in 1969 (George and Hardy 1969). Since then, retardants or their formulations have continued to change. This research note presents recent revisions in calibration and test procedures.

The calibration data were obtained by comparing viscosities from the Brookfield Viscometer with the flow-through times for the Marsh Funnel; thus, "Marsh-Funnel time" serves as an inexpensive method for determining viscosity (fig. 1).

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Figure 1.--Determining viscosity with a Marsh Funnel.

INSTRUCTIONS FOR USING THE MARSH FUNNEL

1. Place the appropriate tip in the Marsh Funnel.
2. Use only fresh samples that have stabilized; i.e., excessive air bubbles have disappeared and complete hydration has occurred (approximately 1/2 to 1 hour after mixing).
3. Cover the funnel tip with a finger and pour the retardant *through* the screen into a clean, dry, upright funnel until the fluid level *exactly* reaches the bottom of the screen.
4. Measure the time in minutes and seconds for 1 quart (946 ml) of retardant to flow through the funnel--the funnel holds approximately 2 quarts (1,892 ml).
5. Look up measured time on left-hand side of table. Read proper column to the right to find viscosity in centipoise.

NOTE:

1. Keep in mind that time elapsed since agitation and retardant temperature influence viscosity. The viscosity found in the table will apply to the retardant only at the time and temperature at which the sample is tested.
2. For the samples tested in the laboratory, the Marsh Funnel method gave viscosities within 5 percent of the Brookfield method.
3. Numbers included within the boxes indicate the normal use ranges.

MARSH FUNNEL TIME - FIRE RETARDANT VISCOSITY RELATIONSHIPS[1]
REVISED 1976

Time for 1 qt (946 ml) to flow thru funnel[2] (min:sec)	Tenogum	Phos-Chek		Fire-Trol			
		XA	259	100		931 gum-thickened[4]	931 concentrate
	lg tip[3]	lg tip	sm tip[3]	lg tip	sm tip	lg tip	lg tip
	Centipoise						
0:10							
:15	310			930		147	
:20	532	557		1530		473	
:25	703	767		1900		727	
:30	843	966	5	2140		934	
:35	962	1155	20	2330		1109	
:40	1065	1334	43	2480	920	1260	
:45	1155	1502	66	2590	1110	1394	
:50	1236	1659	89	2680	1250	1514	
:55	1310	1806	112	2750	1370	1622	
1:00	1377	1942	136	2800	1460	1721	1900
:05	1438	2067	159	2840	1541	1811	
:10	1495	2183	182	2880	1610	1896	
:15	1548	2287	205	2900	1670	1974	
:20	1598	2381	228	2920	1720	2047	
:25	1645	2465	251	2930	1770	2116	
:30	1689	2538	274	2940	1810	2181	
:35	1730		297	2950	1840	2242	
:40	1770		320	2960	1870	2300	
:45	1807		343		1900	2356	
:50	1843		367		1940	2409	
:55	1877		390		1960	2459	
2:00	1910		413			2507	2200
:15	2000					2641	
:30	2081					2761	
:45	2155					2869	
3:00	2222					2968	2500
:15	2283					3059	
:30	2340						
:45	2393						
4:00	2443						2800
:15	2490						
:30	2534						
:45	2575						
5:00	2615						3100
6:00							3400
8:00							4000
10:00							4600
12:00							5200

[1] Viscosities by Brookfield Model LVF, at 60 r/min, spindle 4 (for viscosities of more than 500 cP) or spindle 2 (for viscosities from 1-500 cP); at a temperature of 65-75° F, higher temperatures may give false low viscosities, lower temperatures may give false high viscosities.

[2] Funnel must be full to screen before testing begins.

[3] Large tip diameter should be 0.269 ±0.002 inch; small tip inside diameter should be 0.187 ±0.002 inch.

[4] Viscosity is dependent upon age of gum, storage time and conditions, and degree of agitation prior to use.

The revised table published here includes only products currently being used. New products (since the last revision) are Fire-Trol 931 (LC), gum-thickened Fire-Trol 931, and Tenogum. The formulation of Phos-Chek XA (replacement for 202 or 202 XA) has been altered, although no change in the calibration has been necessary. The viscosity of unthickened, diluted Fire-Trol 931 does not change significantly with the change in dilution rate, and its low viscosity limits the usefulness of Marsh Funnel measurements. (Fire-Trol 931 diluted with water at the rate of four parts water to one part concentrate yields a solution with a Brookfield viscosity of approximately 70 centipoise, or 12 Marsh-Funnel seconds.)

The Marsh Funnel packet is still available. It contains the table, instructions for converting a Marsh Funnel, and a list of commercial sources. Separate tables and the packet can be ordered from the Northern Forest Fire Laboratory, Intermountain Forest and Range Experiment Station, Drawer G, Missoula, Montana 59801.

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